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A CRITICAL REVIEW OF TULSI - OCIMUM SANCTUM

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ABSTRACT

Medicinal plants are an significant part of human history, philosophy and practise. The theme of medicinal plants is highly active arena of systematic study all over the world. Medicinal plants and plant derivate are broadly used in traditional cultures globally and they are becoming progressively popular in contemporary society as ordinary alternatives to synthetic chemicals. Normal products and their offshoots represent more than 50% of all drugs in clinical use. World health organization (WHO) has supported the estimation of therapeutic potential of plants for diseases where we lack safe allopathic drugs. Ocimum sanctum described as sanctified and medicinal plant in ancient literature, commonly known as Tulsi is consequent from 'Sanskrit', which means "the incomparable one". This plant belongs to the family Lamiaceae which is native throughout the Old World tropics and cultivated for religious and medicinal purposes. Several medicinal properties have been recognized to the plant not only in Ayurveda and Siddha but also in Greek, Roman and Unani. It is widely known across South Asia as a medicinal plant and an herbal tea. The chemical constituents isolated from various parts of the plant contain eugenol, cardinene, cubenol, borneol, linoleic acid, linolenic acid, oleic acid, palmitric acid, steric acid, Vallinin, Vicenin, Vitexin, Vallinin acid, Orientin, Circineol, Gallic Acid, vitamin A, vitamin C, phosphorous and iron. Ocimum sanctum has been shown to possess multifarious medicinal properties such analgesic activity, anti-ulcer activity, immunomodulatory activity, Tulsi has got the great medicinal value. Studies have also revealed Tulsi to be effective for diabetes, by reducing blood glucose levels. The same study showed significant reduction in total cholesterol levels with Tulsi. Another study showed that Tulsi's beneficial effect on blood glucose levels is due to its antioxidant properties. The Rama Tulsi is the effective remedy for the severe acute Respiratory Syndrome. Juice of its leaves gives relief in cold, fever, bronchitis and cough. Tulsi oil is also used as the ear drop. Tulsi helps in curing malaria. It si very effective against indigestion, headache, hysteria, insomnia and cholera. The fresh leaves of Tulsi are taken by the millions of people every day.

KEYWORDS: Tulsi, Shyama tulsi, Krishna Tulsi, Ocimum sanctum.

1. INTRODUCTION

The plant kingdom is an excellent source of potential drugs and in the recent years there has been an increasing awareness about the importance of medicinal plants. Plant kingdom is known to comprise approximately 500,000 plant species which are found worldwide, of which only 1% has been phytochemically investigated with an illimitable potential for discovering novel bioactive compounds mainly in medicinal plants. Use of traditional plants and their products have been reported by various investigators for the treatment of diseases.[1] Despite the ever increasing advancement in medical sciences and molecular diagnosis, it is estimated that 80% of the world population is still dependent on plant-derived pharmaceuticals.[2] Tulasi or Vaishnavi holy basil is a sacred Ocimum medicinal and therapeutic value in Hindu belief. Hindus regard it as an earthly manifestation of the goddess Tulsi; she is regarded as a great worshipper of the god Vishnu. Usually, plant leaves or dal are offered in every hymen and ritualistic worship of Vishnu and his incarnation Lord Krishna. Traditionally, In India, Tulsi is planted in the centre of the central courtyard of Hindu houses.[3] The Tulsi plant belongs to small family Lamiaceae and the botanical name is Ocimum sanctum.[4,5] Tulsi is also called ''Queen of herb'', the one which possesses a large number of medicinal properties in herbal drugs.[6] There are two types of Tulsi – Green (Ram Tulsi) and Black (Krishna Tulsi) and both are having nearly the same characteristics.[7,8] Different kinds of species are enclosed in the Genus Ocimum, for instance, Ocimum Sanctum, Ocimum. canum (Dulal Tulsi), Ocimum. kilimandschricum, Ocimum gratissimum (Ram Tulsi) Ocimum. americanum, Ocimum. Camphora, Ocimum. bascilicum (Ban Tulsi) and Ocimum. Micranthu.[9,10]

Tulsi is an excellent herbal medicine, which has been used for five thousand years as it produces an immediate effect on most of the diseases in India. Some of the active constituents of Tulsi gives quick relief, while other active constituents of Tulsi takes a certain time to heal the diseases. It also relaxes the body and boosts up the energy in the body.[11] Ocimum sanctum L. commonly known as holy basil (Tulsi) is an herbaceous perennial, belongs to family Lamiaecae and is considered as one of the most important source of medicine and drugs with many secondary metabolites and essential oils recommended for treatment of malaria, diarrhoea, bronchial asthma,dysentery, bronchitis, skin diseases, arthritis, painful eye disease, chronic fever and eye diseases. Inaddition, Ocimum sanctum also showsanticancerous, antifungal, antimicrobial, antifertility, hepatoprotective, antispasmodic, cardio protective, antiemetic, antidiabitic, analgesic, adaptogenic, anddiaphoretic properties. The pharmacological studies reported in the present research confirm the therapeutic value of O. Sanctum. Therefore, the present study looks into the extraction and preliminary phytochemical analysis of O. Sanctum leaves.

2. ORIGIN, DISTRIBUTION, AND MORPHOLOGY

O.sanctum is straight, a branched shrub that develops up to 30- 60cm in height. The morphology of Tulsi has distinguished as its height is about 30-60cm with the structure of branched fragmented shrub. Their leaves are arranged in the plain, odoriferous, branched, incompatible, thick, and oval-shaped, moreover, they are arranged with dentate margins. Flowers are purple in color and are elongated. Fruits are moderate and seeds are radish yellow in colour. After the rainy season it will be seeded and harvested.

Figure 1: O. sanctum (Tulsi).

Figure 2: Manjari of Tulsi.

3. Horticulture

Holy basil raises in equatorial along with warm regions and it is circulated as well as cultivated throughout the country, especially in India. The ancient Ayurveda literature says that it is cultivated nearly 1800m over the sea level and usually grows in moist soil. It initiates from the Himalayas to Andaman and Nicobar islands, but it is broadly distributed in few sectors of Asia including Africa. Predominantly, OS develops in moist soil and based upon the pattern of soil and differences in the rainfall, size form and therapeutic property of the plant are considered.

4. GANA VARGEEKARANA

Tulasi has been categorized under various Gana or varga (groups) in the classical Sahmita's and Nighantu's (lexicons) of Ayurveda.

Table 1: Showing Gana vargeekarana of Tulasi in Samhita's and Nighantu's.[12,13,14,15,16,17,18,19,20,21,22,23,24,25]

SAMHITA AND NIGHANTU	VARGA/GANA
Charaka Samhita	Shwasahara gana
Susruta Samhita	Surasadi gana
Astanga Hridaya	Surasadi gana and Kaphaghna gana
Astanga Sangraha	Shwasahara gana and Surasadi gana
Bhavaprakasha Nighantu	Pushpa varga
Raja Nighantu	Karaviryadi varga
Dhanwantari nighnatu	Karaviryadi varga
Madanapaala nighantu	Karpuradi varga
Kaiyadeva Nighantu	Oushadi varga
Shodala nighantu	Karaviryadi varga
Priya Nighantu	Shatapushpadi varga
Haritakyadi nighantu	Pushpa varga
Saligrama nighantu	Pushpa varga
Nighantu adarsha	Tulsyadi varga

5. SYNONYMS

Synonyms are the different alternative names defined for particulars in various parts. These synonyms are having specific meaning which gives an idea about the Mythological information Morphological features, Pharmacological properties, Traditional use and Ethno botanical use.

Table 2: Showing various synonyms of Tulasi (Ocimum sanctum Linn).

PARYAYA	BN[26]	DN[27]	RN[28]	KN[29]	MPN[30]	SN[31]	PN[32]	Sh.N[33]	NA[34]
Tulasi	+	+	+	+	+	+	+	+	+
Surasa	+	+	+	+	+	+	+	+	+
Gramya	+	+		+	+	+	+		
Sulabha	+								
Bahumanjari	+	+			+	+			+
Apetarakshasi	+	+	+			+			+
Gowri	+	+	+	+	+	+			
Bhutaghi	+	+	+	+	+	+	+		
Devadundubhi	+	+		+	+				+
Surabhi									
Thivra			+						
Pavani			+						
Vishnuvallabha			+						
Surejya			+						
Kayastha			+	+					
Suradundubhi			+						
Bahupatri			+						
Manjari			+	+					
Haripriya			+						
Shyama			+						
Tridashamanjari			+						
Putapatri			+						
Putapriya				+					

Shrimanjari				+					
Burimanjari				+					
Nagamata				+					
Sumanjari				+					
Butapati				+					
Rajasi				+					
Dalasagrasi				+					
Grasa				+					
Pavitra								+	
Suravallari								+	
Patrapuspa								+	
Sugandha								+	
Andharohini								+	
Mala						+			
Swadugandhachhada				+					
Bhuteshta				+					
Chakraprni				+					
Sakrapatni				+					
Vishnuhita						+			
Vishnupriya						+			
Shrestamata						+			
Vaishnavi								+	
Vrindha								+	+
Amrutha								+	

BN-Bhavaprakasha Nighantu, **DN**-Dhanwantarinighantu, **RN**-Raja Nighantu, **KN**-Kaiyyadevanighantu, **MPN**-Madanapalanighantu, **SN**Shodalanighantu, **PN**-Priyanighantu, **Sh.N** – Shaligrama Nighnatu, **NA**-Nighantuadarsha.

6. VERNACULAR NAMES

Vernacular names are different names of the drug in different languages and hence helpful in identifying the drug in the other parts of world.

Table 3: Showing the Vernacular names of Tulasi.[35]

LANGUAGES VERNACULAR NAMES

Language	Name
Hindi	Kalatulasi, Tulasi
Kannada	Vishnu tulasi, Kari tulasi, Sri tulasi, Tulashi-gida
English	Holy Basil
Malayalam	Tulasi, Trttavu karuttarttavu, Niella tirtua, Krishna - tulasi,Shiva tulasi
Telugu	Tulasi, Gaggera - chettu
Tamil	Tulaci.Karuttulaci
Bengali	Tulasi, Krishna tulasi
Gujarati	Tulasi, Talasi
Punjabi	Bantulsi, Tulsi
Marathi	Tulasa, Tulasi
Konkani	Tulsi

7. VARITIES

Classical Nighantu's of Ayurveda refer to different types/varieties of Tulasi based on the color of leaves.

Table 4: Showing Varieties of Tulasi.

VARITIES	BN[36]	RN[37]	KN[38]	PN[39]	Sh.N[40]	NA[41]	HN[42]
Shweta tulasi	+	+	+	+	+	+	+
Krishna tulasi	+	+	+	+	+	+	+
Karpura tulasi			+				
Ram tulasi						+	

BN-Bhavaprakasha Nighantu, **RN**-Raja Nighantu, **KN**-Kaiyyadevanighantu, **PN**-Priyanighantu, **Sh.N** – Shaligrama Nighnatu, **NA**Nighantuadarsha. **HN** - Haritakyadi Nighantu.

Table 5: Showing Varieties of Ocimum sanctum Linn.[43]

S N	LATI N NAME	SANSKRIT NAME	ENGLISH NAME
1	Ocimum sanctum	Tulasi	Holy basil
2	Ocimum basillicum	Barbari	Sweet basil
3	Ocimum gratissimum	Phanijjaka	Shrubby basil
4	Ocimum americanum	Sweta tulasi	Common basil/American basil
5	Ocimum Kilimandcharicum	Karpura tulasi	Camphor basil
6	Ocimum minimum	Marubaka	Bush basil
7	Ocimum pilosum	Kharapushpa	Green basil

8. RASA PANCHAKA

In Ayurveda, the actions of any herb are analyzed based on the five basic principles, Rasa (taste), Guna(properties), Virya (potency), Vipaka(aftertaste), Prabhava(specialaction).

Table 6: Showing Guna karma of Tulasi (Ocimum sanctum Linn.)

Rasa, Guna, veerya, Vipaka, Doshaghna	Particular	BN[36]	RN[37]	DN[44]	KN[38]	PN[39]	Sh.N[40]	NA[41]
Rasa	Katu	+	+	+	+	+	+	+
	Tikta	+	+		+	+	+	+
	Kasaya				+			
Guna	Laghu			+				
	Tikshna				+			
	Ushna	+					+	
	Ruksha			+	+			
Virya	Ushna			+	+	+		+
Vipaka	Katu				+			+
Doshagnata	Vatakaphahara	+	+		+	+	+	+
	Kaphahara			+				

BN-Bhavaprakasha Nighantu, **RN**-Raja Nighantu, **DN**-Dhanwantarinighantu,**KN**-Kaiyyadevanighantu, **PN**-Priyanighantu, **Sh.N** – Shaligrama Nighnatu,**NA**-Nighantuadarsha.

9. KARMA (ACTIONS) AND ROGAGNATA (INDICATIONS)

The action of any herb is analyzed on the basis of its effect on the Dosha (Humors) of the body. It has been stated that Tulasi has Vatakapha action, i.e. it mitigates Vata and kapha dosha.

Table 7: Showing Karma and Rogaganta of Tulasi (Ocimun sanctum Linn.).

KARMA AND ROGHAGNATA	BN[45]	RN[46]	DN[47]	MPN[48]	KN[49]	SN[50]	PN[40]	Sh.N[41]
Agnidipani				+	+	+		+
Kushtajit				+	+			+
Krcchrasrajit				+				+
Parshwarukjit				+	+	+	+	+
Pittakrut				+	+			+
Hridya				+	+	+		+
Dahakrut				+	+			+
Krimidoshanihanti		+	+		+			
Ruchikrut		+	+					
Jantubhutakrumihara		+					+	
Shwasahara					+	+	+	
Kasahara	+			+	+	+		
Hikkahara	+			+	+	+		
Krumisudana	+			+				
Pratishyayaghna	+			+				
Vranyashodana	+			+			+	
Jwaraghna								

Chardighna					+			
Mutrakrcchra					+			
Ashmari					+			
Netraroga					+			
Vishaghna					+			
Putigandha						+		

BN-Bhavaprakasha Nighantu, **RN**-Raja Nighantu, **DN**-Dhanwantarinighantu, **MPN**- Madanapalanighantu, **KN**-Kaiyyadevanighantu, **SN**Shodalanighantu**,** **PN**-Priyanighantu, **Sh.N** – Shaligrama Nighnatu, **NA**-Nighantuadarsha.

10. PHYTOCHEMISTRY

Ocimum basilicum L. Contains (-)-linalool (30-40%), eugenol (8-30%), and methyl chavicol (15-27%). Minor basil oil constituents are (+)-delta-cadinene, 3-carene, alphahumulene, citral, and (-)-trans-caryophyllene.[12] Thai basil oil contains methyl chavicol (93.0%), eugenol (41.5%), gammacaryophyllene (23.7%), and methyl eugenol (11.8%) as major compounds Hoary basil oil contained high amounts of geraniol (32.0%) and neral (27.2%) and small amounts of methyl chavicol (0.8%).[51] *Linum usitatissimum*, oil contains high alpha-linolenic acid contents mainly eicosanoid precursor polyunsaturated fatty acids (PUFA) which are highly anti-inflammatory.[52] *Ocimum basilicum* L. EO contains eugenol (67.4% and 72.8%), β-elemene (11.0% and 10.9%), β-caryophyllene (7.3% and 8.4%), and germacrene D (2.4% and 2.2%), while the major components in *O. basilicum* cvs. "Vikarsudha" and "CIMSoumya" were methyl chavicol (68.0% and 64.9%) and linalool (21.9% and 25.6%), along with bicyclogermacrene (2.0% and 0.7%) and α-terpineol (1.2% and 0.1%). Eugenol (77.2%), 1,8-cineole (7.6%), germacrene D (2.7%), and β-caryophyllene (1.7%) were identified as the major constituents of *Ocimum gratissimum* (OG).

11. BIO-POTENTIAL OF TULSI

11.1 Analgesic Activity

Singh et al., in 1995 studied the Analgesic activity of fixed oil from the seeds of *Ocimum sanctum* (OS) in mice and rats using the tail flick, tail clip, tail immersion and acetic acid-induced writhing methods. It was found to be effective against acetic acid induced writhing in dose dependent manner suggesting that writhing inhibiting activity of the oil is peripherally mediated due to combined inhibitory effects of prostaglandins, histamine and acetylcholine.

11.2 Antiasthmatic Activity

50% aqueous ethanol extract of dried and fresh leaves and the volatile and fixed oils of OS was evaluated against histamine and acetylcholine in leaves and fixed oil from the seeds significantly protected the guinea pigs against histamine and acetylcholine induced preconvulsive dyspnea. However, the 50% ethanol extract of dried leaves did not protect the guinea pigs against histamine induced preconvulsive dyspnea.[53]

11.3 Antibacterial Activity

Antibacterial activity of the aqueous, alcoholic, chloroform extract and oil obtained from leaves of *Ocimum sanctum* were studied against *E.coli*, *P.aeruginosa*, *S. typhimurium* and *S.aureus*. Extract obtained from OS were observed equally effective against pathogenic gram-positive and gram- negative bacteria.[54]

11.4 Anticancer Activity

Antimelanoma activity of 50% alcoholic aqueous leaf extract of different species of Ocimum was studied by Monga et al. in 2011. Leaf extract administered orally (200mg/kg, p.o.) resulted in significant reduction in tumor volume, increase in average body weight and survival rate of mice.[55]

11.5 Anticataleptic Activity

Aswar et al in 2010 studied the anticataleptic activity of the aqueous extract (300 mg/kg, i.p) and the alcoholic extract (300 mg/kg, i.p) of the leaves of *Ocimum sanctum* and observed a significant ($P < 0.001$) reduction in cataleptic scores.[56]

11.6 Anticonvulsant Activity

Different extractives of stem, leaf and stem callus of *Ocimum sanctum* were tested for anticonvulsant activity against standard drug phenytoin using maximal electroshock (MES) model. Ethanol and chloroform extractives of stem, leaf and stem calli were effective in preventing tonic convulsions induced by transcorneal electroshock.[57]

11.7 Antiemetic Activity

Tulsi leaves also check vomiting and used for antiemetic action.[58]

11.8 Anti-helminthic Activity

The essential oil of *Ocimum sanctum* and eugenol, tested in-vitro, showed potent anthelmintic activity in the Caenorhabditis elegans model.[59]

11.9 Antihyperlipidemic and Cardioprotective Activity

Suanarunsawat et al in 2010 studied the antihyperlipidemic and cardioprotective activity of *Ocimum sanctum* fixed oil in rats fed with a high fat (HF) diet and concluded that treatment with OS fixed oil decreased the high serum lipid profile and expressed antiartherogenic and cardioprotective actions against hyperlipidemia. The anti-hyperlipidemic action of OS fixed oil was mainly resulted from the suppression of liver lipid synthesis. Linolenic acid and linoleic acid

contained in *Ocimum sanctum* fixed oil were possibly responsible for both lipid-lowering and cardiac protective action against hyperlipidemia.[60]

11.10 Antihypertensive Activity

The OS fixed oil administered i.v. produced hypotensive effect in anaesthetized dog which seems to be due to its peripheral vasodilatory action. Essential fatty acids like linoleic and linolenic acid contained in the OS oil produce series 1 and 3 (PGE1 and PGE3) prostaglandins and inhibit the formation of series 2 prostaglandins (PGE2).[61]

11.11 Antistress Activity

Fresh leaves of *Ocimum sanctum* were evaluated for antistress activity against experimentally induced oxidative stress in albino rabbits by Jyoti et al in 2007.[62]

11.12 Antianxiety and Antidepressant Activity

Chatterjee et al in 2011 studied the effect of ethanolic extract of leaves of *Ocimum sanctum* in Swiss albino mice against both anxiety and depressive disorder. Depression was studied through tail suspension test and forced swim test. Anxiety experiments included light dark test, elevated plus maze test and hole board test. The *Ocimum sanctum* extracts shows antianxiety and antidepressant properties at the same dose and can be a potential therapeutic agent against mixed anxiety and depressive syndrome.[63]

11.13 Demulcent/Stimulant/Expectorant

Traditionally, juice of the leaves of OS plant was used as demulcent, stimulant and expectorant. The seeds are mucilaginous and demulcent and are given in different ailments of genito-urinary system. An infusion of leaf had been used as anti-spasmodic in gastric disorders of children.[64]

11.14 Eye Disease

The leaf juice of *Ocimum sanctum* along with triphala is used in ayurvedic eye drop preparations recommended for glaucoma, chronic conjunctivitis and other painful eye disease. In daily routine one may use about three drops of tulsi oil along with honey and it is supposed to improve eye sight.[65]

11.15 Hepatoprotective Activity

Lahon et al in 2011studied hepatoprotective activity of *Ocimum sanctum* alcoholic leaf extract against paracetamol-induced liver damage in albino rats synergism with silymarin and concluded that *Ocimum sanctum* alcoholic leaf extract showed significant hepatoprotective activity and synergism with silymarin.[66]

11.16 Immunomodulatory Activity

Jeba et al in 2011studied that aqueous extract of *Ocimum sanctum* at the oral doses of 100, 200 mg/kg/day in rats enhances the production of RBC, WBC, haemoglobin and also enhanced the production of antibodies without affecting the biochemical parameters.[67]

11.17 Neuroprotective Activity

Ocimum sanctum shows ameliorative potential in attenuating vincristine induced peripheral neuropathic pain in rats which may be attributed to decrease in oxidative stress and calcium levels. Administration of OS (100 and 200 mg/kg p.o.) and its saponin rich fraction (100 and 200 mg/kg p.o.) for 14 days significantly attenuated vincristine-induced neuropathic pain along with decrease in oxidative stress and calcium levels.[68]

11.18 Radio-protective Activity

Joseph et al in 2011 studied the radioprotective effect of *Ocimum sanctum* on the salivary gland of rats administered radio iodine radio-protectant, amifostine. OS and amifostine presupplemented and subsequently exposed to (131) I rats at 3 and 6 months duration exhibited comparable histopathology with controls. The study indicated possible radioprotective effect of OS and amifostine against high-dose (131) I exposure24. Flavonoids extracted from the leaves of OS were studied as a radio-protector on the erythrocyte antioxidants in oral cancer. Results of the study suggest that erythrocytes from cancer patients responded to oxidative stress by elevating glutathione level while a decrease in glutathione levels observed in OS flavonoids treated patients could be due to the free radical scavenging effect of OS flavonoids, sparing the glutathione. However, OS flavonoids did not seem to exert its effect on other antioxidants of erythrocytes.[69]

12. CONCLUSION

All these medicinal constituents makes Tulsi a must have for extended and nonviolent life. This small plant is definitely a very good source of therapeutic things. After in depth and rigorous research it has been proved and certified that it is safe to consume Tulsi in any form. Contemporary era scientific research into tulsi proves the many psychological and physiological benefits from consuming tulsi and delivers a testament to the wisdom inherent in Hinduism and Ayurveda, which celebrates tulsi as a plant that can be worshipped, ingested, made into tea and used for medicinal and divine purposes within circadian life. The present review indicates the importance of Tulasi as one of the significant medicinal plant designated for its pharmacological actions and indications in the Ayurvedic lexicons and it is extensively used in treating various types of jwara (fever), tamaka swasa (bronchial asthma), kasa (cough) and hikka (hiccough). The numerous researches have evidenced many of its actions stated in Ayurvedic classics and validate its actual use in numerous diseases.

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